Photo-Therapy 4000 Training

I. Medical Fundamentals
1. Introduction

Jaundiced Newborns

- In almost every case:
- 50 % of normal newborns are jaundiced
- 80 % of prematures have visible jaundice

Phototherapy

- Most frequent form of therapy in Neonatology
- 10 % of all jaundiced babies receive Phototherapy

What is Jaundice in Newborns ?

Meaning:

Excess metabolism products

BILIRUBIN

Recognizable by yellow skin color

(from ca. 7mg/dL in the blood serum)

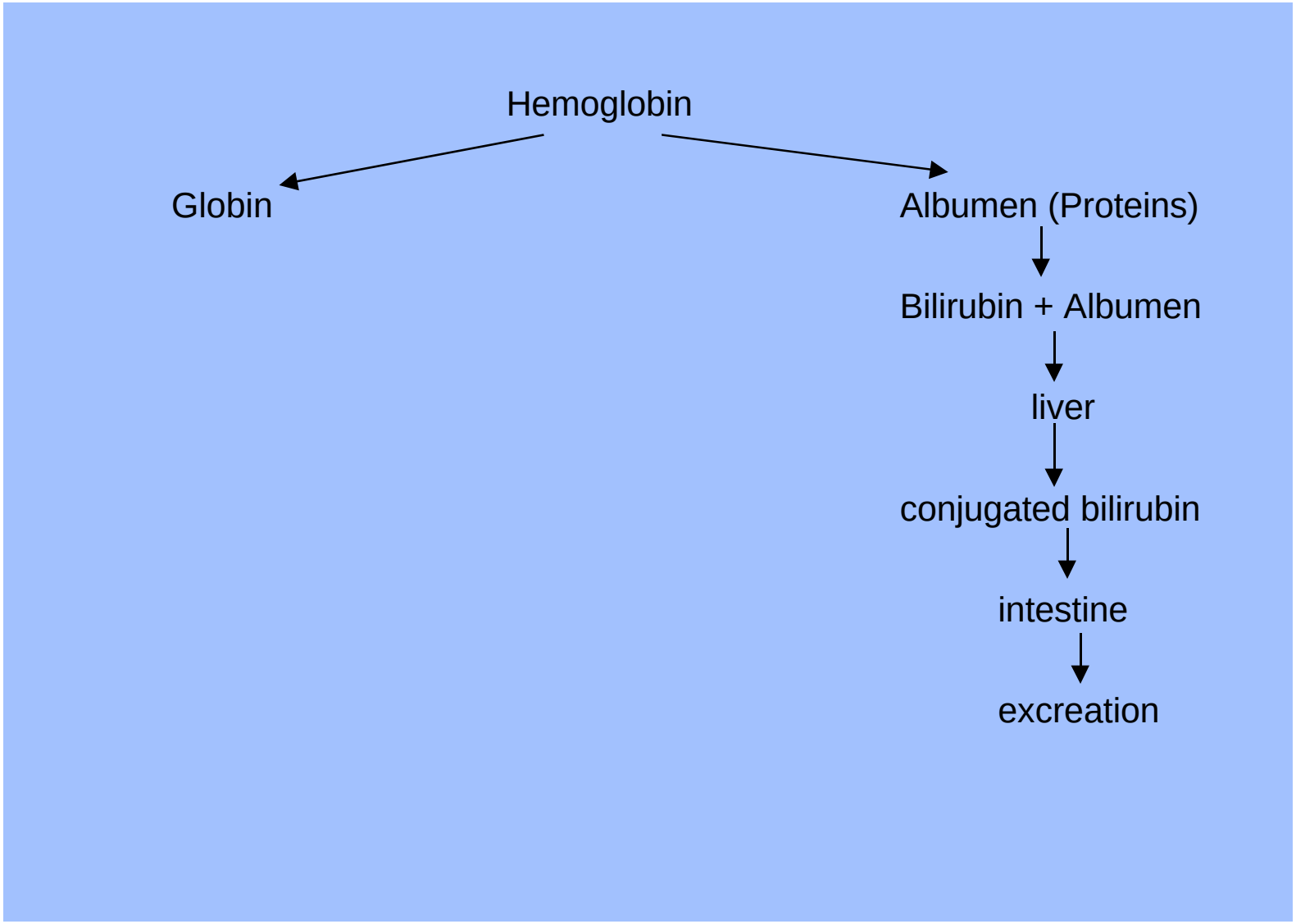
Concept:

Jaundiced Newborns

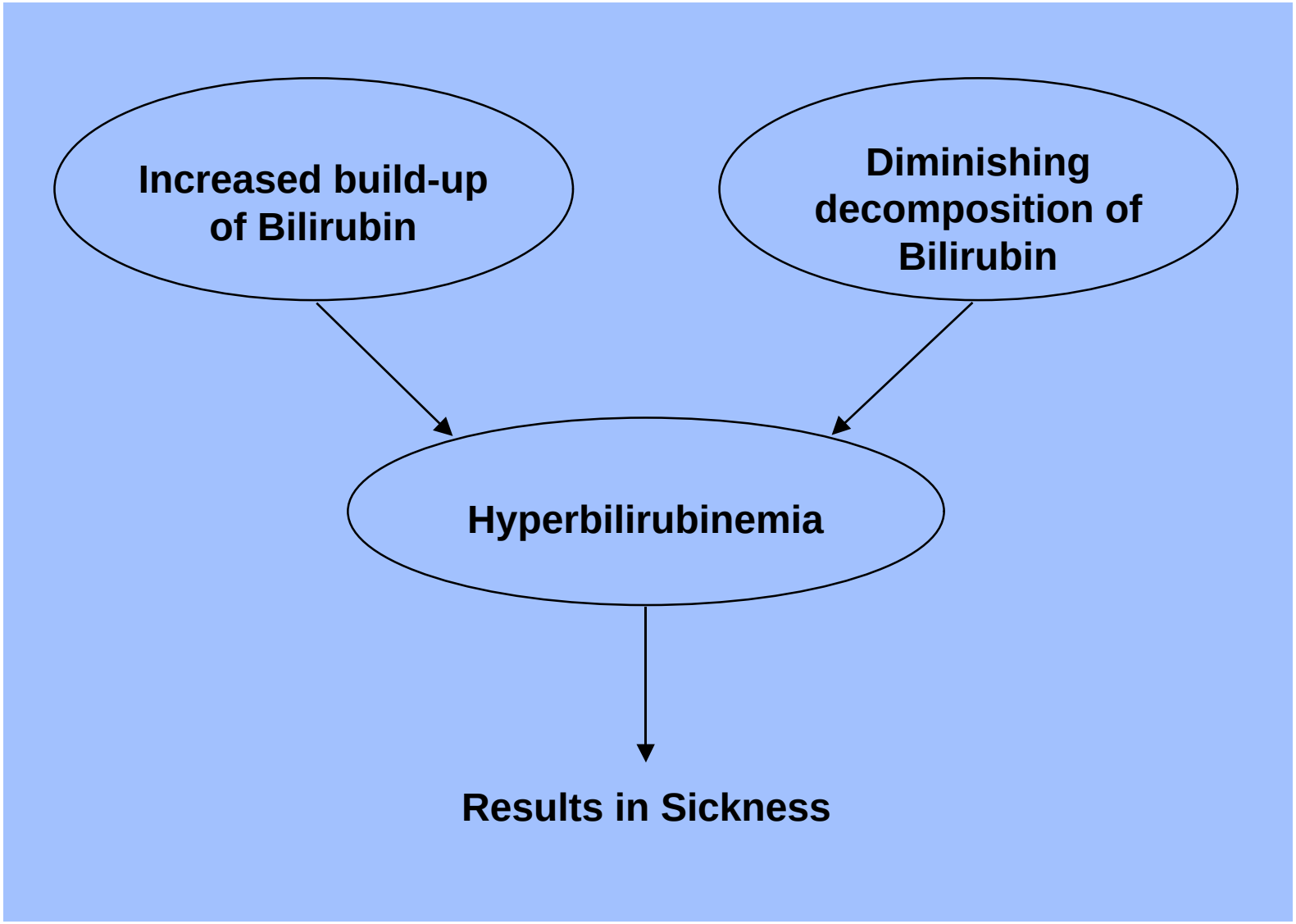
= Hyperbilirubinemia

= Icterus of the newborns

2. Metabolism



3. The Situation in Early- and Newborns



3.1 The Origin of Unequal Weights

Before Birth:

a) Oxygen supply is from the Placenta

-->instead of 160 mmHg of atmospheric oxygen-the placenta possesses only SpO_2 pressure

Result: ca. 40 - 50 %
increase in the number of red blood cells

After Birth:

Oxygen supply through the lungs, slightly longer life of the fetal's blood cells, quicker decomposition of the surplus of blood cells, increased decomposition of Bilirubin products.

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b) Bilirubin decomposition in the Placenta

--> Liver builds no UPDG to conjugate Bilirubin

Bilirubin decomposition in liver:
Bilirubin conjugation is reduced where the prior existance of UDPG is too low.

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c) No intestinal bacteria

- No corrosion of the conjugated Bilirubin by intestinal bacteria.
- The recomposition of unconjugated Bilirubin. (through Glucuronization=digestion secretions)
- Reabsorption into the blood stream.

3.2 Results of Hyperbilirubinemia

- Bilirubin not bound to Albumin has an affinity to cell membranes usually resulting in yellow-colored skin.
- There the Bilirubin can overcome the blood-brain boundary and bind to cells in the brain and nervous system
  - ☒ Kernicterus
- Toxic effects of the nerve cells increase with Bilirubin concentration.
- Yellow-color of the ganglia, the central thalamus and the core "olives" in the brain (autopsy).

3.3 Symptoms of Kernicterus

- Fever
- Cramps
- Low Heart Frequency
- Shrill Crying
- Tendency to Bleed
- In Extreme Case, Death

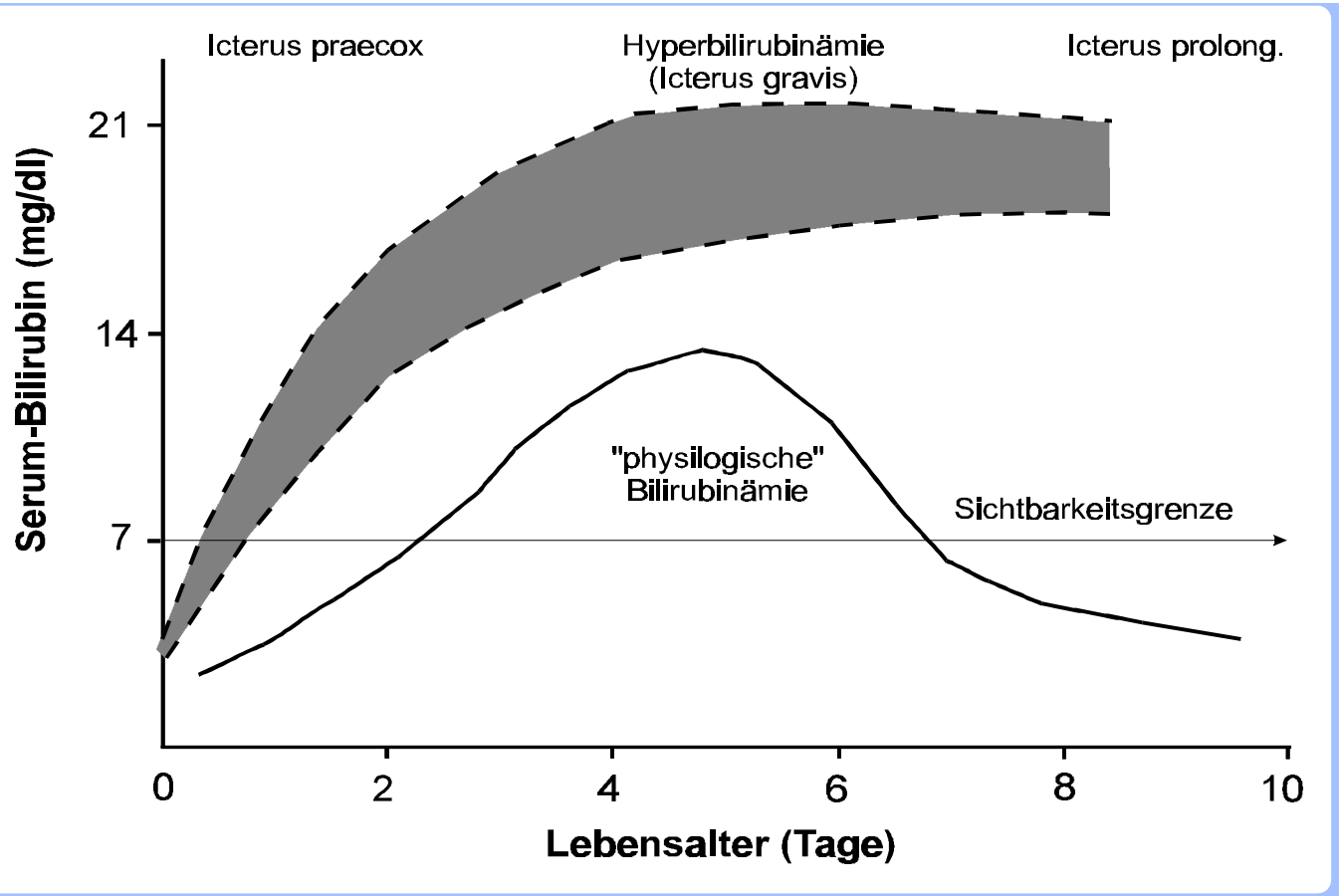
<u>Resulting Illnesses:</u>

Central nervous system remains damaged and scarred by:

- Spastic Paresis
- ➡ Paralyzed Vision
- Disturbed Hearing

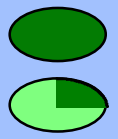
Newborn Icterus is a tough, life-endangering sickness that remains a harmful threat over one's entire life.

3.4 Timeline of Icterus



- The Bilirubin concentration's physiological and pathological courses compared to age.

4.4 Results of Phototherapy

	Portion of Pigment in Serum	Halfife
Bilirubin-Isomers	ca. 18 %	 2 h
Lumirubin	ca. 4 %	15 h
Oxidation Produkts	ca. 1 %*	unknown
	*estimated	

5. Alternative Ways to Treat Icterus

- Blood transfusion

  very quick degeneration of the Bilirubin serum

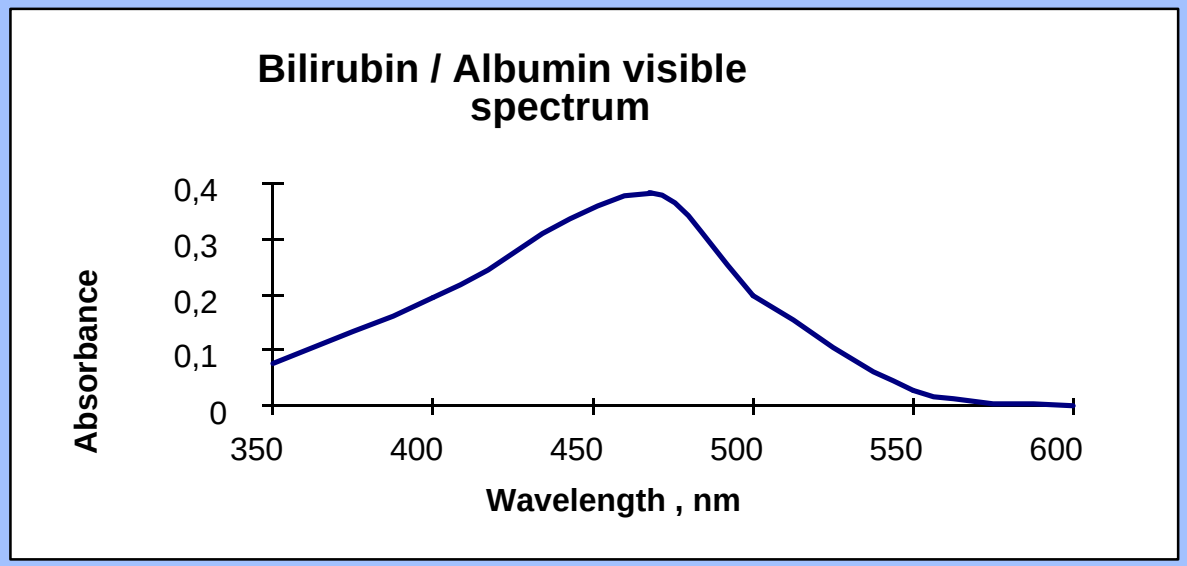
- Medication

  Stimulates the production of Ligandin and UDPG
  Slow degeneration of the Bilirubinserum, side effects

- Absorption substances

  Oral doses of substances preventing the reabsorption from the intestines into the bloodstream only effective in combination with Phototherapy

II. Device Technology
1. Absorption Spectrum

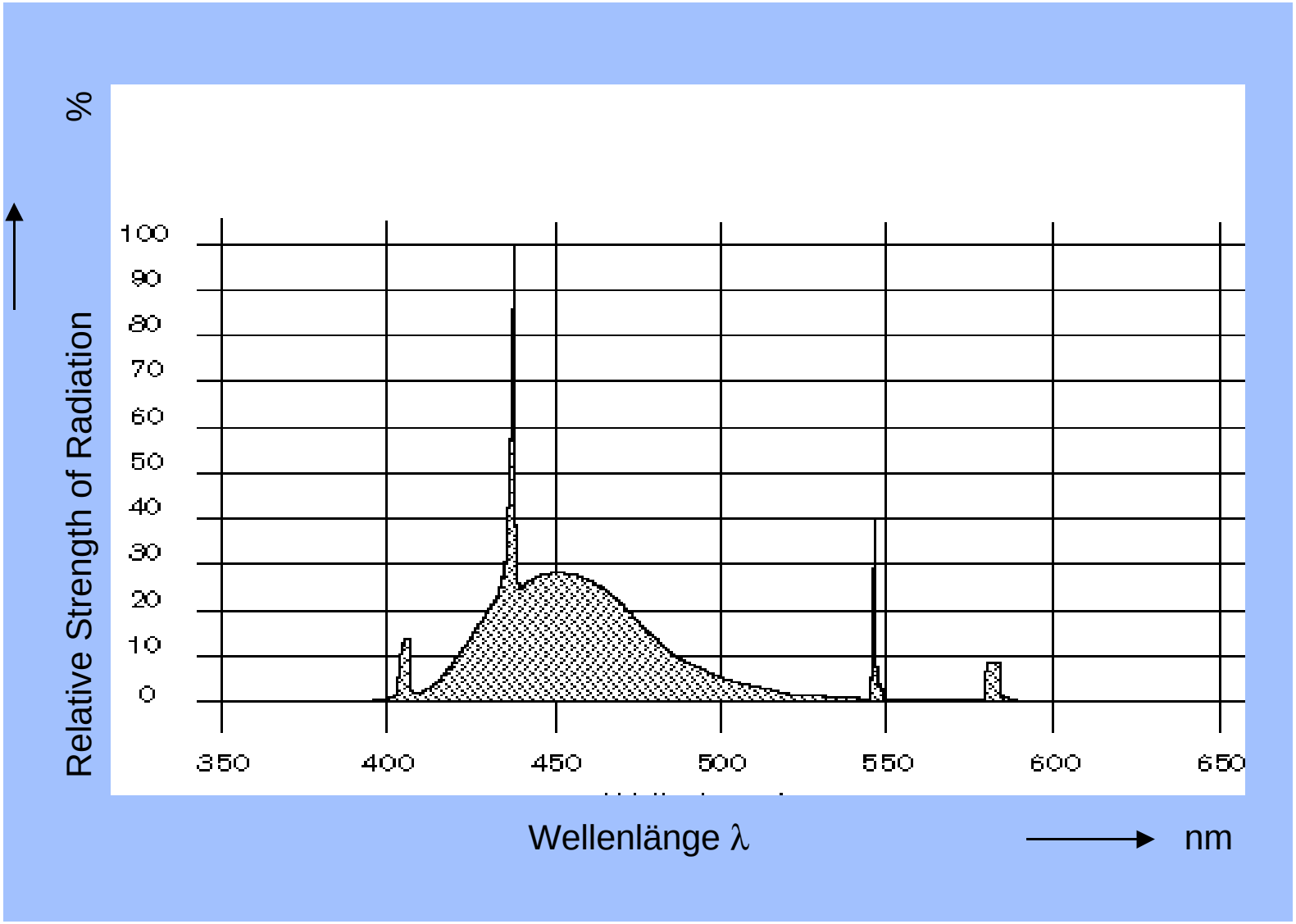


Absorption spectrum of Bilirubin in combination with Albumin

➡

optimal effectivity of 460 nm

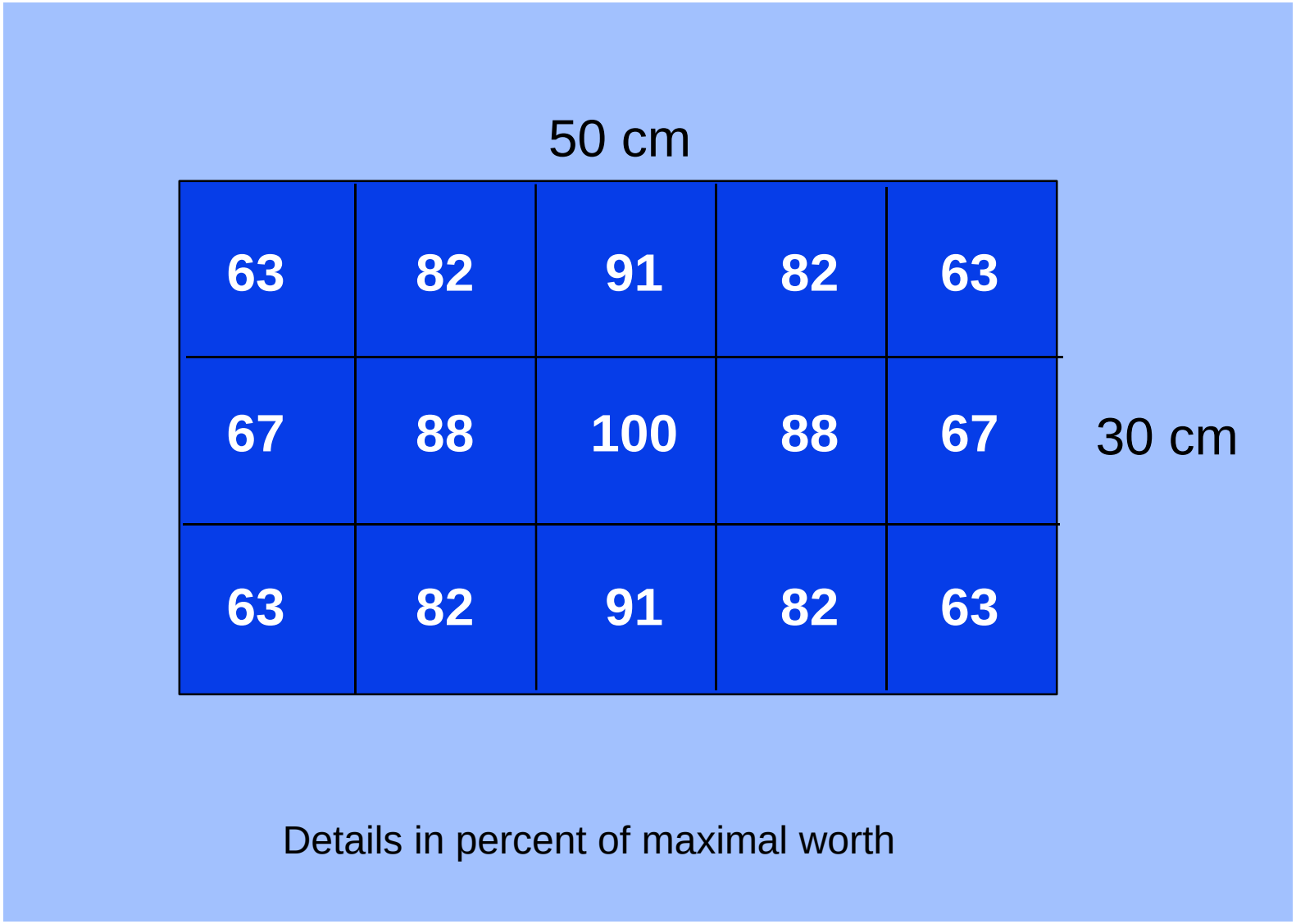
5.2 Phototherapy 4000 Spectrum



5.3 Intensity of Rays

Distance cm			30	40	50
E_{bi}	mW/cm^2	4 blue light lamps	2,4 ± 0,4	1,6 ± 0,3	1,2 ± 0,2
		6 blue light lamps	3,4 ± 0,6	2,3 ± 0,4	1,6 ± 0,3

5.4 Rays Distribution



5.5 Handling